Federating Distributed, Heterogeneous Content Distribution Actors

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Agenda

- Introduction
- Main Challenge: How to enhance Telcos' Positioning in the CDN Market
- Our Contribution
  - Context & Goal
  - Proposed Technical Solution
- Final Words and Work in Progress

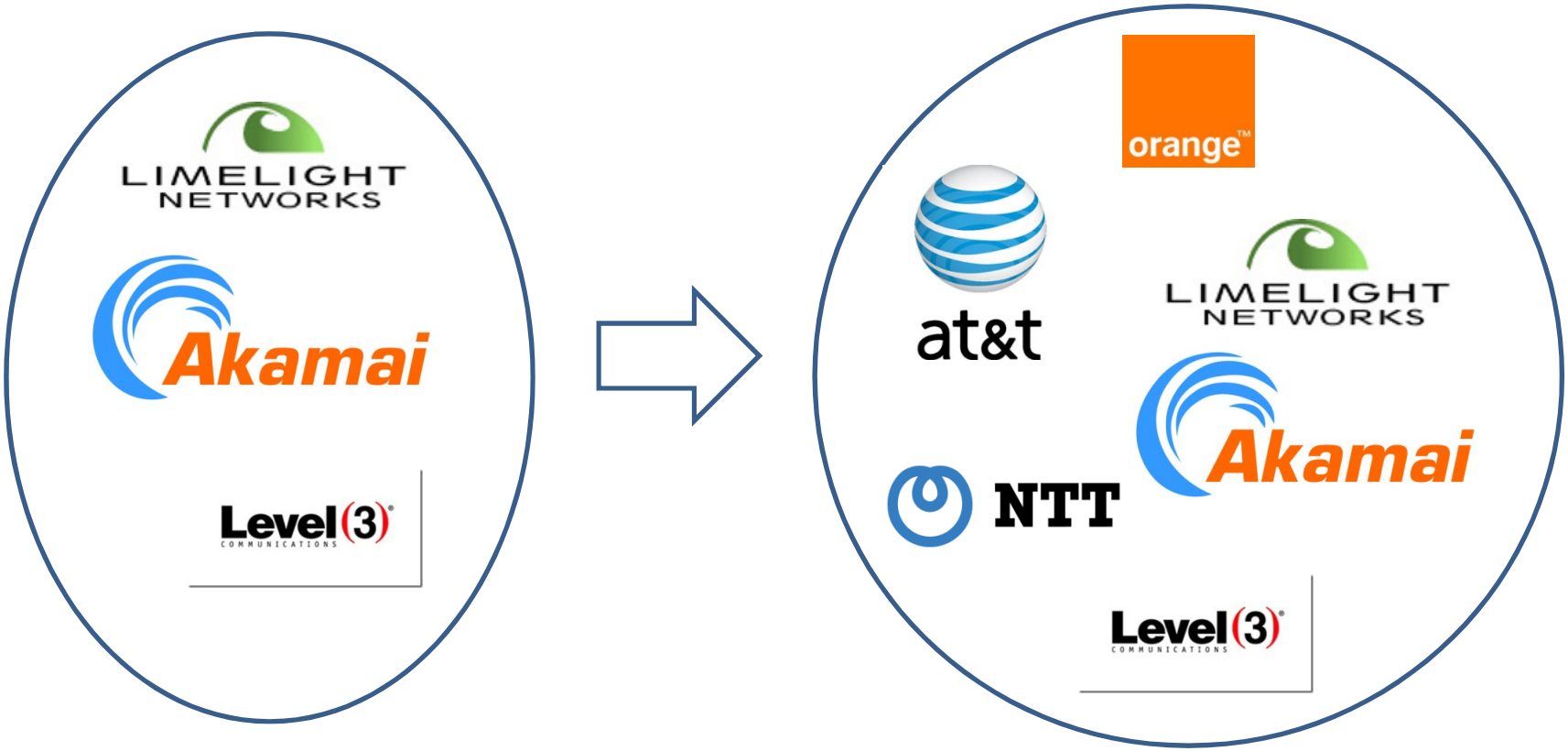
Introduction

Content Distribution Value Chain

Content Consumers / Prosumers | **Network Providers (Telcos)** | **CDN Providers** | **Content Providers** | **Content Producers**

Introduction

Overview of the CDN Market



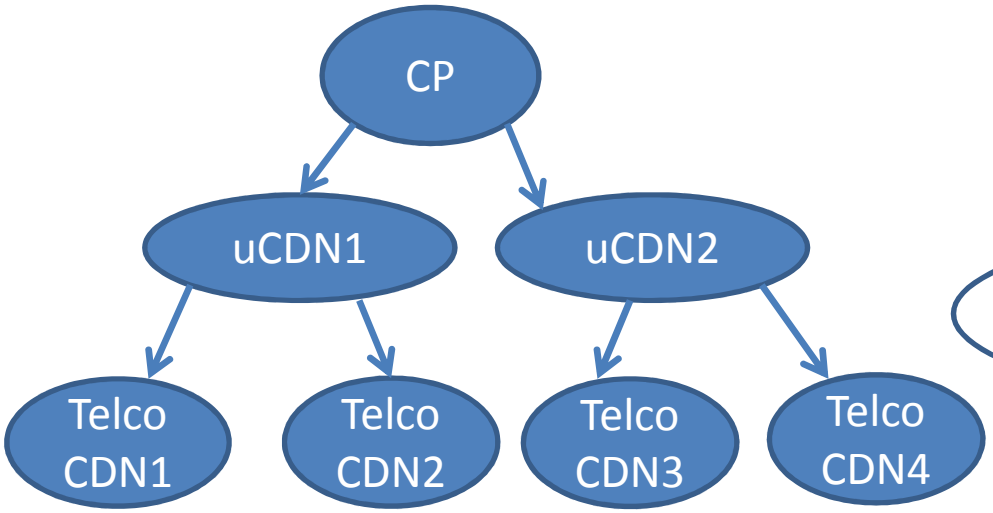
Market concentrated around a reduced set of Global CDNs

Local/Regional Actors, like Telcos, are targeting a better market positioning

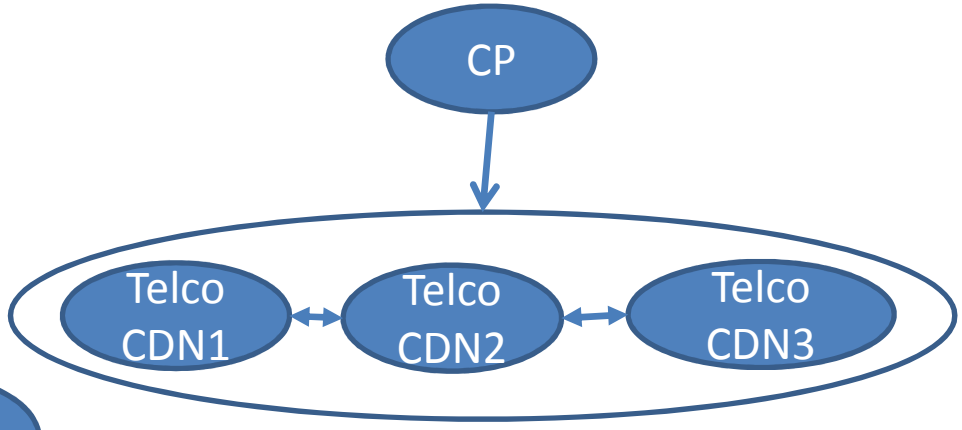
Main Challenge: How to enhance Telcos positioning in the CDN Market?

Many Scenarios are possible, general examples:

Sc1: Upstream-Downstream Federation



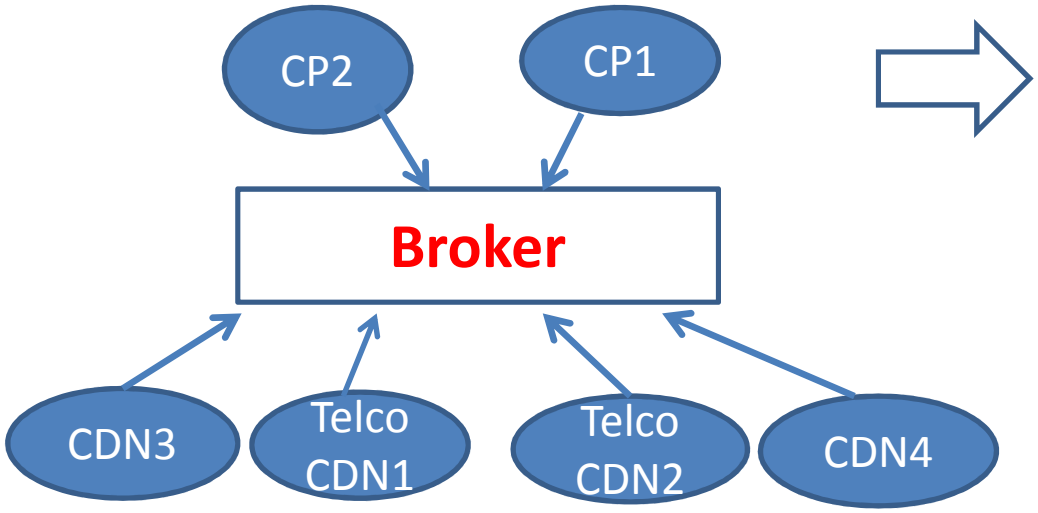
Sc2: Federation of local actors



Main Challenge: How to enhance Telcos positioning in the CDN Market?

Many Scenarios are possible, general examples

Sc3: Orchestration of distributed CDN services



In Scenarios 2 & 3, the broker functional group has an important role

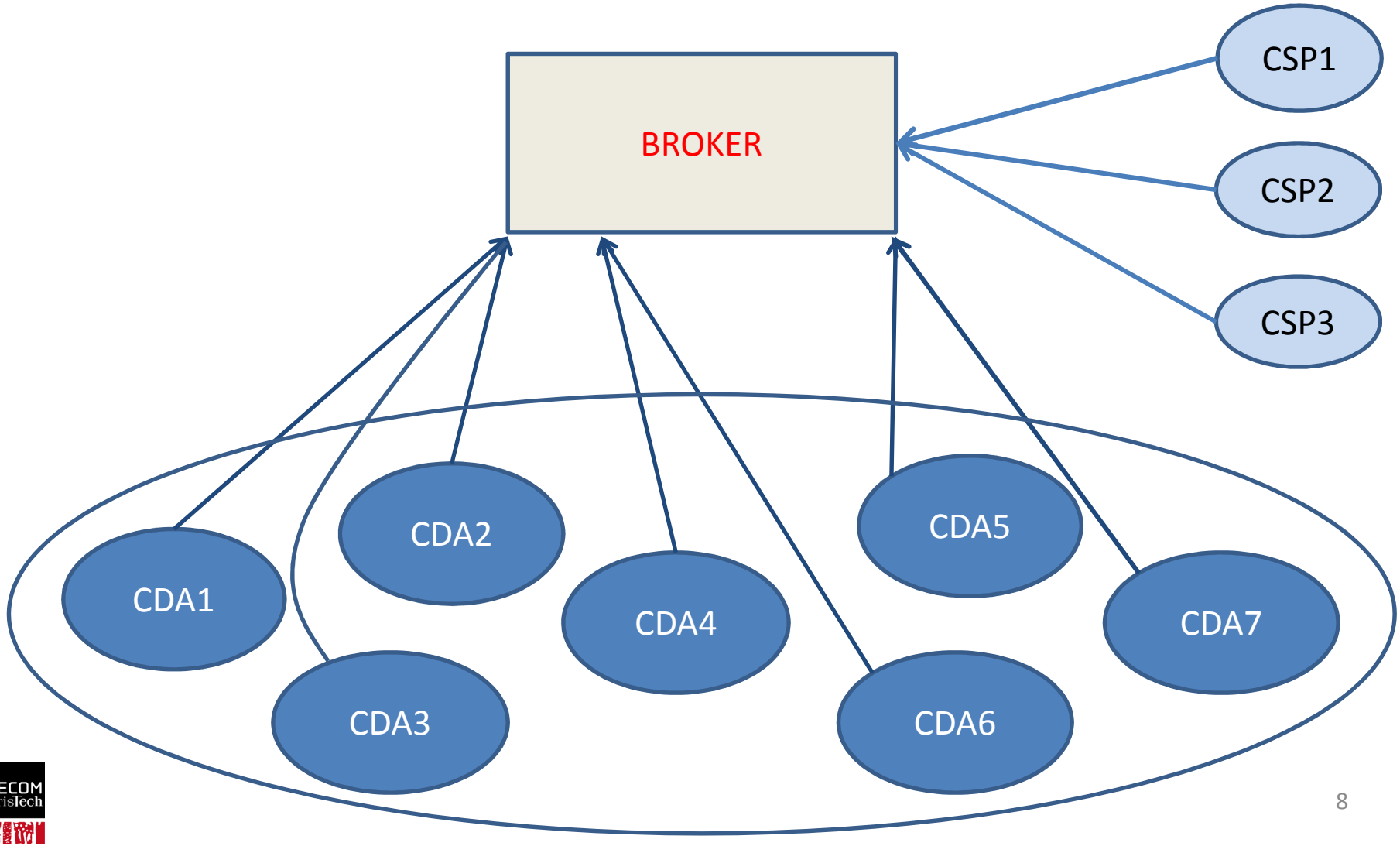
The role can be played by one of the CDNs or by a 3rd party

Our Contribution: Context and Goal

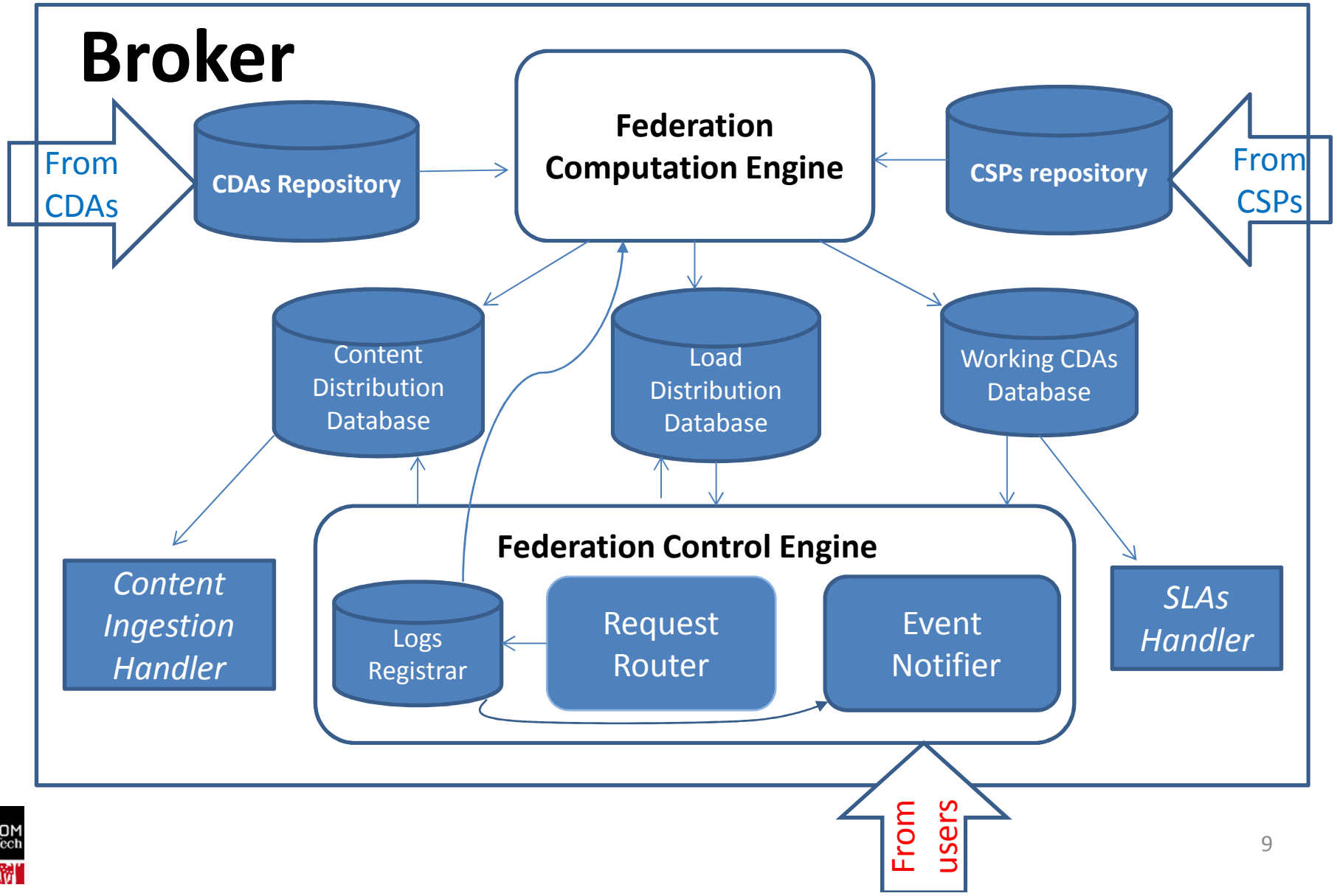
- We introduce a broker-based architecture for statically building and dynamically orchestrating large federations of content distribution actors (CDAs). Our ecosystem is composed of:

  - Heterogeneous, highly distributed CDAs
  - Content Providers and global CDNs

Technical Aspect: Control Architecture



Technical Aspect: Control Architecture



Technical Aspect: Control Architecture

Broker Role: 2 phases

Static/ pre-provisioning Phase:

- At t0, repeated each T
- Handled by the “Federation Computation Engine”
- Based on Inputs gathered from CDAs and CSPs
  - CDAs inputs: Capacity, Footprint (zones) and Price information
  - CSPs inputs: Target Footprint, Demand profile, Content characteristics
- Leads to outputs concerning content and load distribution policies within different working CDAs

Technical Aspect: Control Architecture

Broker Role: 2 phases

Dynamic Phase

- In]t0, t0+T]
- Handled by the “Federation Control Engine”
- The Request Routing strategy is dictated by the output of the Static Phase
- The Broker subscribes to “CDAs” performance and adapts accordingly the static phase outputs
- The Broker maintains demand logs and uses them as inputs to re-perform the static phase at to+T

Final Words & Work in Progress

- Telcos could be better positioned in the CDN Market
- Flexible federation and services orchestration will significantly facilitate such better positioning

  → An **Advanced Brokering Architecture** represents in this context a major asset
- Standardization efforts should be focused on the definition of the functional and protocol architecture.
  - Includes data models and **Interfaces** to facilitate the autonomic orchestration to answer CSPs and external CDAs services requests.
- We are working on the design of decision making **Algorithms** required for dynamic CDN selection inside the federation and for resources orchestration
  - We consider different market relevant scenarios → **different Points of View** can be adopted
- We will be glad to further detail our proposals and to contribute to the standardization process

Food For Discussion:

Is SDN as a technology relevant in a context of CDAs orchestration/ federation? Why? How?

Thank You

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Appendix

Static Phase: Decision Making Process

At t0 do{

- Classify SPs in “SPs Repository” into Groups on Footprint and Technology features basis
- Filter Groups per Footprint order (begin with groups with the smallest Footprint)
- For each SP Group do {
  - Identify from “CAs Repository “ all Candidate actors / Foot(Actor) ≤ Foot(Group) & Feature(Actor) = Feature(Group)
  - Apply Mathematical Model, SPList: SPs in SP Group & CDNList: Candidate Actors
  - Remove Selected Candidates from “CAs Repository “
  - Store Selected Candidates Ids in the “Working CAs database”
  - Fill the “Content Distribution database” and the “load distribution database” with the computed content and load distribution Indicators
  - Go to Next SP Group }
- Restore “CAs Repository” Initial Content }

Appendix

Dynamic Phase: Decision Making Process

At t , ≥t0, ≤ t0+T do 1 and 2{

1. Intercept Incoming Requests
   For each Req do {
   Identify the originating zone and the target content
   Access the "Load Distribution database" in order to Forward the Req to the adequate CA }
2. For each CA/ CA Id in "Working CAs database" do {
   - Track CA performance Level over his footprint zones
   - If (CA.PerfLevel (zone x)< L) {
     Generate Event(CA Id, zone x)
     Fetch the "Logs Registrar" for CA recent history (]t-T1,t])
     Identify the contents that have been the most recently delivered by CA to zone x
     Decrease the share of load handled by CA over zone x and corresponding to identified contents
     adapt the "Load Distribution database " accordingly
     Redistribute the load among other actors that cover zone x based on their preference order
     adapt the "Load Distribution database" and the "content distribution database" if required accordingly }
   } }